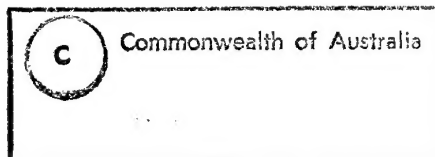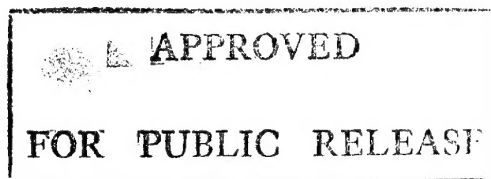AR-006-921

DSTO-GD-0020

A Questionnaire for the Cost-benefit Analysis of an Insensitive Variant of the Mk82 HE General Purpose Bomb

A. White

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Ⓒ Commonwealth of Australia

DEPARTMENT ◆ OF DEFENCE

DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION

A Questionnaire for the Cost-Benefit Analysis of an Insensitive Variant of the Mk82 HE General Purpose Bomb

A. White

Weapons Systems Division
Aeronautical and Maritime Research Laboratory

DSTO-GD-0020

ABSTRACT

An Insensitive Munitions (IM) policy, described in DI(G) LOG 07-10, is being implemented by the Australian Defence Organisation. DSTO was tasked to develop a methodology to assess the cost-benefits afforded by the introduction of IM, which is a critical component in the implementation of this policy. As part of this task, it is being applied to two munitions to refine and validate the methodology. This report describes a questionnaire devised to obtain input data for the estimation of the cost-benefit afforded by the introduction of an insensitive variant of the Mk82 HE General Purpose Bomb. It may be used as an example of a questionnaire to obtain similar types of data for other studies.

RELEASE LIMITATION

Approved for Public Release

DEPARTMENT OF DEFENCE
———————◆———————
DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION

Contents

1. Introduction

The Australian Defence Organisation (ADO) has issued a Defence Instruction (General) [1] implementing an insensitive munitions (IM) policy to reduce the risks and hazards associated with explosives ordnance. Cost-effectiveness is one of the major requirements for the introduction of an IM variant of a particular munition system, in conjunction with sensibility and practicability. To assist the ADO in assessing the cost-effectiveness of insensitive munitions, Explosives Ordnance Division AMRL was tasked by the Assistant Chief of the Defence Force (Development) to develop a suitable methodology to estimate the cost-effectiveness of the introduction of an IM variant of a weapon system.

As the main aim of introducing IM is to reduce the severity of accidents (and hence reduce the cost in dollars and suffering), it was decided that the best method of measuring cost-effectiveness was through the estimation of the cost-benefits involved (see [2] for a discussion of cost-effectiveness, cost-benefit and related concepts). After reviewing existing methodologies [3], a methodology to estimate the cost-benefits of the introduction of an IM variant of a munition system was proposed [4] based on the pNIMIC methodology [5]. A computer program was also written to conduct the cost-benefit analysis and sensitivity analyses and Monte-Carlo simulation of the input parameters [6]. Following refinement and validation of the methodology, a document describing the proposed Australian methodology and how it should be implemented is to be published [7].

To conduct this refinement and validation process, the methodology is being applied to two munition types, the Mk82 HE General Purpose Bomb and 5"/54 Naval ammunition. This document presents the questionnaire sent to RAAF personnel to obtain information and input data for the cost-benefit analysis of introducing an IM variant of the Mk82 bomb.

2. Questionnaire Structure

2.1. Overview

The questionnaire is presented in the Annex. Initially, an introductory page gives background information on the originators of the questionnaire, why the information is required and where responses should be sent, followed by a page of instructions on how to answer the questions. A small section then asks for information on the person completing the questionnaire ("the respondent"). This section was very useful in indicating the background and experience of the individual because this person was often not the original addressee (the task of replying to the questionnaire having been passed on to a more qualified officer or delegated to a junior officer). At the end of the questionnaire is a page asking for further suggestions.

The remainder of the questionnaire is concerned with obtaining information about the environments experienced by the Mk82 bomb and the probabilities and consequences of accidents. There are six sections, each of which is discussed in more detail below:

1. General aspects of the Mk82 bomb (2 pages)
2. Qualification and introduction into service of an IM variant of the Mk82 bomb (1 page)
3. Storage of Mk82 bombs (4 pages)
4. Transport of Mk82 bombs (7 pages)
5. Operational use of Mk82 bombs - peacetime (6 pages)
6. Operational use of Mk82 bombs - wartime (7 pages)

Not all sections were sent to every addressee (see section 3 for more detail).

2.2. Common elements

In an attempt to provide a method of weighting answers, each section commenced with a sliding scale for the respondent to indicate their self-rated level of expertise in answering that particular section (following the method used in [8]):

	0	1	2	3	4
Your level of expertise:	├———————┼———————┼———————┼———————┤				

The divisions used correspond to:

0 Unfamiliar -	The respondent has no knowledge of the subject or cannot say anything meaningful about it.
1 Casually acquainted -	The respondent knows what the subject is about but cannot meaningfully quantify their feelings about the factors involved.
2 Familiar -	The respondent knows the general issues involved but would not be able to discuss the technical issues in any depth.
3 Very familiar -	The respondent was an expert some time ago but is a bit rusty now or is on the way to becoming an expert but still has some way to go; or works in a particular area or on a particular site and so is an expert in some aspects but not all.
4 Expert -	The respondent currently works in the area and feels that they are an authority on the subject.

However, as very few responses were obtained with little or no overlap in answers, weighting of answers was not possible.

Respondents were also asked to indicate a range of uncertainty for each answer in an X ± Y form. Y could be an absolute value, a percentage of X or an order of magnitude. Ranges of uncertainty for costs could usually be expressed as absolute values (eg $1 000 ± 50) while for uncertainty in probabilities, orders of magnitude were more useful (eg 10^{-5} ± 1 order of magnitude).

Several questions required answers to be plotted, usually in the form of log-linear graphs (eg, Figure 1). These plots indicate the variation in the number of units in the inventory or on a particular site over a period of time, such as the service life or the time spent at war.
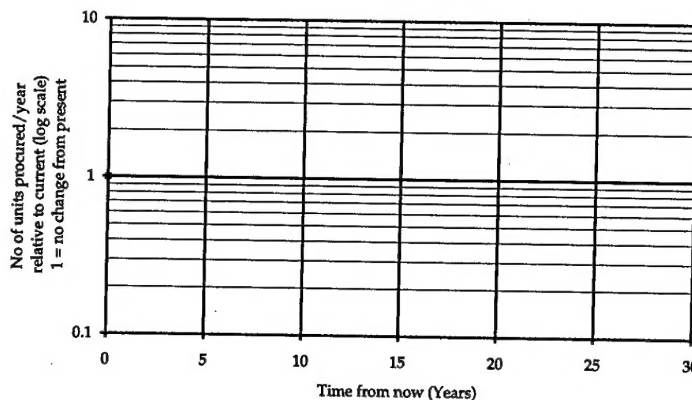
Figure 1: Log-linear plot

2.3. Section 1 - General aspects of the Mk82 bomb

This section was designed to obtain details on the bomb cost, inventory (during both peace and war) and service life.

2.4. Section 2 - Qualification and introduction into service of an IM variant of the Mk82 bomb

The purpose of this very short section was to obtain an estimate of the qualification cost of introducing an IM variant of the bomb.

2.5. Section 3 - Storage of Mk82 bombs

This section was designed to obtain numbers of bombs stored at each site, and estimates of the probabilities and consequences of accidents if the bombs responded by

detonating (non-IM) or burning (IM). In addition, there are three questions at the end (3.22 - 3.24) which ask respectively:

- how many accidents that the respondent is aware of that have occurred in storage involving bombs
- over what period did these occur, and
- over what period does the respondent know that there have been no accidents at storage facilities involving these stores.

The purpose of these questions was to obtain supplementary data which could be used to obtain alternative estimates of the accident probability via the Poisson method. The following sections also had analogous questions for the same purpose.

2.6. Section 4 - Transport of Mk82 bombs

After some preliminary questions on the number of units transported and the variation in this number over the expected life of type, this section divides the time spent by the Mk82 bomb in transport into three generalised scenarios:

- Scenario 1: Where the vehicle carrying the bombs spends the most time
- Scenario 2: Where the probability of an accident is the highest, and
- Scenario 3: Where the consequences of an accident are likely to be most severe.

For example, if the vehicle in question was a truck carrying bombs from an ammunition depot to a base, Scenario 1 might be the open road, Scenario 2 the loading/unloading operation and Scenario 3 when the truck is travelling through built-up areas. In some cases, one or more of the scenarios might be identical, for example if the vehicle does not travel through built-up areas, the loading/unloading operation may be where the probability of an accident is highest and the consequences are most severe.

In each scenario, the respondent is asked to describe the time spent and the distance covered in this scenario. This was to allow for possible weighting of the scenarios. In addition to requesting information on the respondents' impressions of the damage that would be caused in the case of an accident involving non-IM and IM bombs, the respondent was asked to indicate the position of buildings and vehicles in the scenario. This was to provide a secondary method of estimating the damage to the buildings and vehicles from blast and fragmentation calculations.

2.7. Sections 5 and 6 - Operational use of Mk82 bombs - peacetime and wartime

The operational use mode was divided into "operational use - peacetime" and "operational use - wartime" as it was thought that the wartime operational use environment (combat) would be very different from the peacetime (training) one, eg different airfields may be used, different bombloads may be carried and different procedures may be required. Most details of the questions in each scenario are similar to those described for the transport scenario except for one question at the end of the operational use - wartime scenario (6.16) which was composed of several parts. This question was for the purpose of obtaining information on the effect of a performance difference of the IM variant compared to the current variant so that parameters in the analysis (eg, inventory of the IM variant) could be scaled to allow for the difference in the number of bombs required to achieve the same operational requirements.

3. Distribution and Response

As the questionnaire was very long and would be very daunting, in addition to the preliminary pages each addressee was only sent those sections which were seen as relevant to their particular site. The sections sent to particular addressee groups in the RAAF are shown in table 1.

Table 1: Distribution of questionnaire

Addressee	Section					
	1	2	3	4	5	6
COs of Operational Squadrons	Y				Y	Y
Base Armament Officers	Y		Y		Y	Y
CO EOD Log Sqn 1CAMD	Y	Y	Y	Y		

Initially, ten copies of the questionnaire were sent out. One questionnaire was completed and returned promptly but when no others were received, reminders were sent out a month later. This resulted in a further four questionnaires being returned. Subsequent communications resulted in one further response after an extended period of time. However, as at least one response was obtained from each major base, enough information was obtained to conduct the analysis. If more than one questionnaire was sent to the same base (for example, to the COs of two squadrons and the base armament officer) it is possible that the others were superfluous as the base armament officer may be forwarded the other copies to complete as the most qualified officer. When contacted, the reason generally given by a unit for not responding or giving a delayed response was that there was a lack of effort available to do these types of exercises due to the unit being stretched to capacity just performing the day-to-day operations required of it by its own chain of command.

There were very few responses on improving the questionnaire. I think that the general feeling was that it was too general and that the person completing the form did not feel qualified to answer many of the questions. Unfortunately, in this type of study with very little 'hard' data and some subjective judgements to be made, it may be impossible for the respondent to give a quantitative and clear cut answer which they feel comfortable with. In addition, the generality in the questionnaire was necessary to cover all possible situations, some of which the authors may not have been aware of. The comment was also made that it may be better for a DSTO officer to travel to the units either to get a better feel for operations conducted by those units or to obtain the information directly.

At the time of issuing the questionnaire, it was felt that much of the information requested would be on files, etc and would require some time for the respondent to retrieve. Consequently, it was felt that a questionnaire would be the most convenient method to acquire this information. In retrospect, I feel that the questionnaire may have been too daunting and respondents were put off answering questions which they may have had a feel for by the preceding questions that they had no feel for. If the process were to be repeated, I would be more selective in choosing addressees for each question to try to have the right person answer the question rather than attempting to get a consensus of opinions from several people who do not feel qualified to respond to the question.

4. Conclusions

In general, while the response to the questionnaire was disappointing, it was successful in achieving the desired goal, ie obtaining enough information to give a sufficiently accurate picture of the environment and risks associated with the Mk82 bomb to allow an estimate of the cost-benefits of introducing an IM variant for the purposes of refining and validating the methodology. The questionnaire is presented here so that it is easily accessible and might provide a basis for other studies which need to obtain similar types of information from either the ADO or the public.

5. References

1   Department of Defence (1993).
     Insensitive munitions policy. DI(G) LOG 07-10.

2   White, A. and Parker, R.P. (1995).
     Cost-benefit analysis concepts for insensitive munitions policy implementation. DSTO Technical Report, in publication.

3   White, A. and Parker, R.P. (1995).
     A critical review of current methodologies for cost effectiveness analysis of insensitive munitions. DSTO Technical Report, in publication.

4   White, A. and Parker, R.P. (1993).
     Towards an Australian methodology to evaluate the cost-benefit of insensitive munitions. 1st Australasian Explosive Ordnance Symposium (Canberra).

5   Møller, F.A. (1991).
     A method for cost benefit analysis of insensitive munitions. Pilot NATO Insensitive Munitions Information Center.

6   White, A. (1994).
     A program for the cost-benefit analysis of insensitive munitions, including sensitivity analysis and Monte-Carlo simulation. DSTO General Document, GD-0008.

7   White, A. and Parker, R.P.
     A proposed methodology for the cost-benefit analysis of insensitive munitions for the Australian Defence Organisation. DSTO Technical Report, in preparation.

8   US Department of Defense, National Defense University (1978).
     Climate change to the year 2000 - a survey of expert opinion.

Annex - Questionnaire

Questionnaire for
Cost-benefit Analysis of Insensitive Munitions -

Mk82 HE General Purpose Bomb

This questionnaire has been sent to you because we believe that you have experience in one or more areas of the life-cycle of the Mk82 bomb. If the questionnaire is not relevant to you or your unit, please indicate who each section would be relevant to and return the questionnaire. Please copy the questionnaire to give to other people who may be able to provide an input. The object is to receive as many informed responses as possible

The information requested in this questionnaire is required to develop a methodology to analyse the cost-benefits of the introduction of insensitive munitions (IM) as part of a high-priority task, ADF92/299 "Cost Effectiveness of Insensitive Munitions", sponsored by ACDEV. The insensitive munitions policy of the Australian Defence Organisation is described in DI(G) LOG 07-10. This policy states that "IM are to be introduced into Service with the Australian Defence Organisation, where it is sensible, practicable and cost-effective to do so" and that "all further procurement of Defence explosive ordnance should meet the applicable Insensitive Munitions criteria ..., subject to considerations of the cost benefits". Hence, an evaluation of the cost effectiveness of IM alternatives is an important part of the procurement process and consequently DSTO were tasked to develop a methodology which will assist Service personnel in doing this evaluation. The information requested will help to refine the methodology and will provide a worked example (in the Mk82 bomb) for future referral.

The questionnaire was prepared by Dr A. White and Mr R.P. Parker of Materials Research Laboratory DSTO. Respondents will have the opportunity to comment on the results of the analysis before it is finalised.

Please fill out the questionnaire to the best of your experience/ability and return it (appropriate to its security classification) **as soon as possible (if possible within one week of receipt)** to:

Dr Alex White
Weapons Systems Division - Salisbury
DSTO Salisbury

Any questions/comments etc should be directed to:

Dr Alex White	OR Mr Robert Parker
Weapons Systems Division - Salisbury	Weapons Systems Division - Melbourne
DSTO	DSTO
PO Box 1500	PO Box 4331
Salisbury SA 5108	Melbourne VIC 3001
Phone: (08) 259 5726	Phone: (03) 9626 8521
Fax: (08) 259 6585	Fax: (03) 9626 8510

Thank you for your effort in completing this questionnaire and returning it promptly.

General Instructions

The questionnaire is arranged in sections:

General aspects of the Mk82 bomb
Qualification and introduction into service of an IM variant
Storage
Transport
Operational use - peacetime
Operational use - wartime

You may have received one or more sections. If you have not received sections that you may be able to contribute to, there is a section at the end of the questionnaire that you can complete to prior to returning the questionnaire, and the relevant sections will be sent to you.

Each section has a sliding scale for you to indicate your level of expertise in answering that particular section:

	0	1	2	3	4
Your level of expertise:	├───────┼───────┼───────┼───────┤				

The divisions used correspond to:

0 Unfamiliar - You have no knowledge of the subject or cannot say anything meaningful about it.

1 Casually acquainted - You know what the subject is about but cannot meaningfully quantify your feelings about the factors involved.

2 Familiar - You know the general issues involved but you would not be able to discuss the technical issues in any depth.

3 Very familiar - You were an expert some time ago but are a bit rusty now or you are on your way to becoming an expert but still have some way to go; or you work in a particular area or on a particular site and so are an expert in some aspects but not all.

4 Expert - You currently work in the area and feel that you are an authority on the subject.

Please attempt to answer **all** questions in sections of which you do have some knowledge (ie rate yourself 2 or higher).

Classified information may be required. If you enter such information (up to Secret), please mark the applicable page as such and classify the document appropriately before returning it. If information is classified higher than Secret, please indicate that the question cannot be answered because of classification.

If answers are partial, eg applying only to your location, please mark them as such. Please indicate where the answers you give relate only to a particular variant of the bomb. It is accepted that the answers given may reflect your personal knowledge of local situations.

Some questions ask you to give a range for your confidence in the answer. This may be in the form of ±x%, ±1 order of magnitude etc.

Please add additional pages if there is insufficient room. Please feel free to write explanatory notes or comments wherever they seem relevant.

Personal Information

Name:_____   Questionnaire No:_____

Rank:_____

Unit:_____

Location:_____

Contact phone number:_____

1. General aspects of the Mk82 bomb

```
                                    0     1     2     3     4
Your level of expertise:           ├─────┼─────┼─────┼─────┤
```

1.1. Mk82 bomb unit cost: $_____ ± _____

1.2. Total inventory (in all phases of life-cycle):   MOD1:_____ ± _____

                                                       MOD2*:_____ ± _____

1.3. Expected life of type (this question must be answered as it is frequently referred to in subsequent questions. If you have no idea of the life of type but expect it to be longer than 30 years, please tick the box and use 30 years for the life of type in subsequent questions):

_____ ± _____years   **OR**   ☐ Life of type long but unknown, using 30 years.

1.4. During the period in your answer to 1.3, what amount of time do you think a conflict situation will exist, ie there will be armed military engagements between Australia and some other party (ie, in response to credible contingencies, etc.) involving the Mk82 bomb either in attack or being attacked :
_____ ± _____years. This is the "period of war" that will be referred to later.

1.5. Period of peace = Answer to 1.3 — Answer to 1.4 = _____ ± _____

1.6. How do you expect the total peacetime inventory to vary over the life of type (extend scales if necessary). The total inventory in this context is the total peacetime munition stocks including Operating Stocks and Reserve Stocks (definitions from DI(G) LOG 06-4):
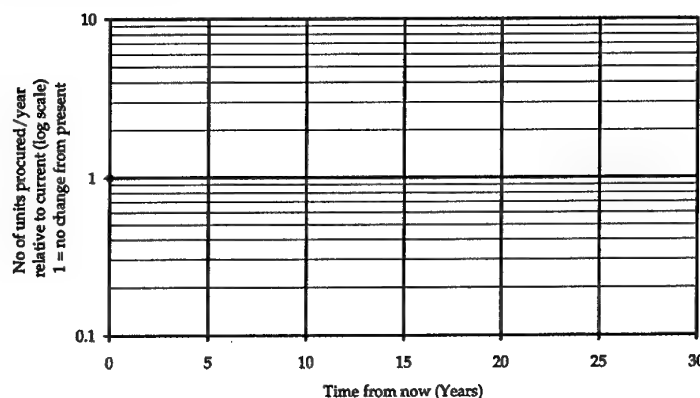
Classification of this page: .... (when data entered)

1.7. On what basis do you expect this variation:_____

_____

_____

1.8. How do you expect the total inventory to vary over the period of war specified in 1.4 (extend scales if necessary):
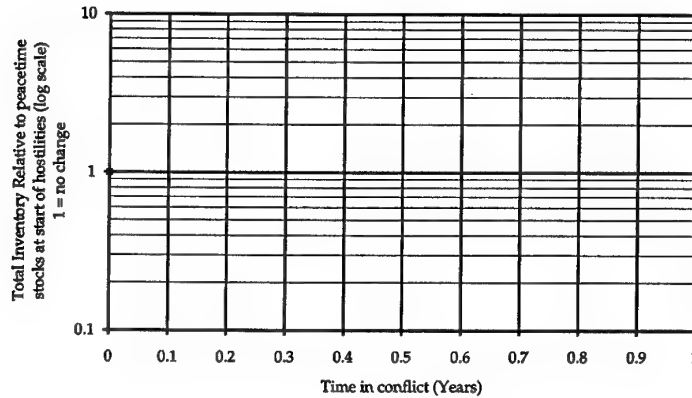
2. Qualification and introduction into service of an IM variant of the Mk82 bomb

| | Your level of expertise: | 0 | 1 | 2 | 3 | 4 |

2.1. If a variant of the Mk82 bomb with an insensitive explosive filling (ie bomb dimensions, case manufacture, etc all remain as before, only the filling is changed) was to be qualified and introduced into service:

(a) How long do you think it would take: _____ ± _____ days/years

(b) How much would it cost: $ _____ ± _____

(c) Who would be responsible:

Name:_____

Rank:_____

Unit:_____

Location:_____

3. Storage of Mk82 bombs

	0	1	2	3	4
Your level of expertise:					

3.1. Total no of Mk82 units stored on your site at 2400 on 30/11/93 : _____
(the time and date are given so that there is no "double-counting" in case any major movements have occurred between sites)

3.2. How do you expect the number of Mk82 units stored on your site to vary over the expected life of type specified in 1.3 (extend scales if necessary):
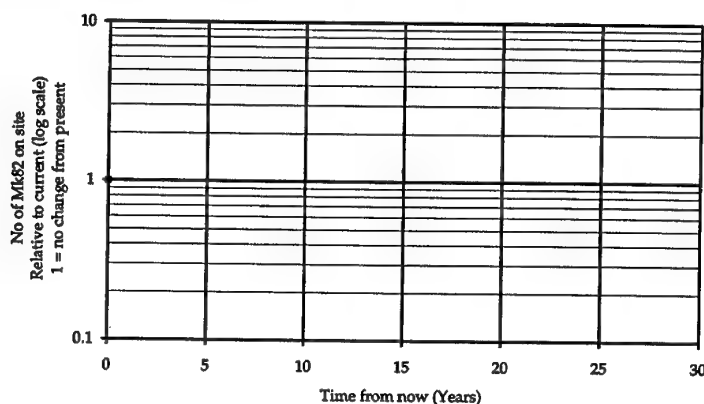
3.3. On what basis do you expect this variation:_____
_____
_____

The following questions are designed to estimate the frequency and costs of accidents of Mk82 bombs in storage. You are asked to analyse a "typical" storage situation on your site, eg one type of storehouse in one arrangement of other buildings. It is not necessary to carry out the analysis for every individual building on the site, only for each significant type of storage situation. While it is understood that the questions may imply a gross oversimplification of the actual situation, please try to impart as much information as possible. Please do not be limited by the questions given if there is other relevant information that you can give. "Storehouse" is used to mean any area where explosives are stored, inspected, maintained, etc during general "storage" of the munition.

If there are several areas on the one "site" with significantly different types of storage environment or handling operations and which have no significant interaction (ie the consequences of an incident at one area would not significantly affect the others) then please treat each area as a different site and copy and complete this section for each one.

3.4. Description of site (eg 1CAMD Magazine Storage Area 1):_____
_____
_____

3.5. Type of storehouses (eg 10 cm thick brick walls, corrugated iron roof, traversed):

_____

_____

3.6. No of storehouses on the site: _____

3.7. No of bombs per storehouse: _____ ± _____

3.8. How are the bombs stored in the storehouse (eg 6 bombs to a pallet, pallets stacked 3 wide by 6 long by 3 high, 3 stacks 1 metre apart; please draw diagram if necessary):

_____

3.9. Are other materials (explosive or non-explosive) stored in the same storehouse (please list):

_____

3.10. Estimated cost of replacement of storehouse: $ _____ ± _____

3.11. Proximity of other explosive storehouses (please draw sketch on back if necessary):

Type and number	Distance (m)	Building replacement cost (each)	
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____

3.12. Proximity of other non-explosive buildings (please draw sketch on back if necessary):

Type and number	Distance (m)	Building replacement cost (each)	
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____
_____ ( )	_____	$ _____	± _____

3.13. Do you have any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

Classification of this page: .... (when data entered)

3.14. What do you think the result on the storehouse would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in the storehouse detonate simultaneously_____

_____

(b) all Mk82 burn only (not all necessarily ignite at same instant)_____

_____

3.15. What do you think the result on surrounding storehouses and other buildings would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in initial storehouse detonate_____

_____

(b) all Mk82 burn only (not all necessarily ignite at same instant)_____

_____

3.16. How many, if any, fatalities would you expect if:

(a) all Mk82 in initial storehouse detonate   _____ ± _____fatalities

(b) all Mk82 burn only   _____ ± _____fatalities

3.17. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in initial storehouse detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

3.18. What do you think is the average probability of an accidental initiation per storehouse during the period of peacetime (specified in 1.5) that can be expected at your site (eg 10^{-6} would indicate a one in a million chance of an accidental ignition per storehouse): _____ ± _____

3.19. What do you think is the average probability of an "unintentional" initiation per storehouse at your site that can be expected during the period of war (specified in 1.4) including initiation of our own Mk82 bombs due to enemy action (eg 10^{-1} would indicate a one in ten chance of an accidental ignition during the period specified in 1.4): _____ ± _____

3.20. Are there any other significant **types** of Mk 82 bomb storage or handling facility on your site:
Yes / No
If so, please repeat questions 3.4 – 3.19 for each type of storage facility, indicating relative quantities stored in each type.

Classification of this page: .... (when data entered)

Classification of this page: .... (when data entered)

3.21. Are there any other **types** of operations carried out on Mk82 bombs on your site which are especially significant or hazardous: Yes / No
If so, please repeat questions 3.4 – 3.19 for each operation.

3.22. How many serious explosive accidents do you know of that have occurred in Australia involving the Mk82 bomb or similar stores (eg other GP bombs) at storage facilities (please attach details if available):   ·   _____accidents

3.23. Over what period did these occur :   _____years

3.24. Over what period do you know that there have been **no** accidents at storage facilities involving these or similar stores (eg over past 11 years):   _____years

3.25. What other sites do you know of that store Mk82 bombs and who do you think is responsible for storage aspects of the Mk82 bomb at those sites:

Location:_____   Location:_____   Location:_____
Name:_____   Name:_____   Name:_____
Rank:_____   Rank:_____   Rank:_____
Unit:_____   Unit:_____   Unit:_____

4. Transport of Mk82 bombs

Your level of expertise:	0 1 2 3 4

4.1. Mode of transport (air/land/sea): _____

4.2. Total no of Mk82 bombs transported/year by this mode:_____ ± _____

4.3. How do you expect this number to vary over the expected life of type specified in 1.3 (extend scales if necessary):
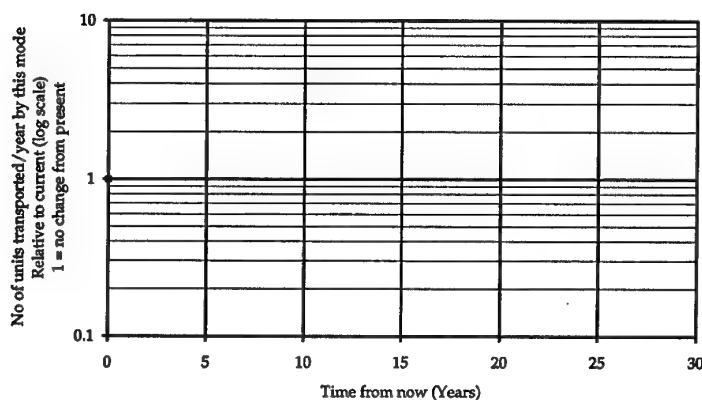
4.4. On what basis do you expect this variation:_____
_____
_____

The following questions are designed to estimate the frequency and costs of accidents of Mk82 bombs in transport. There are three sets of questions relating to three different transport scenarios (where the vehicle carrying the bombs spends most time, where an accident is most likely or where the consequences of an accident would be most severe). Please fill out the three scenarios so that they include all the possible environments that the bombs may experience in transport – this may require some averaging of times, probabilities, etc. It is not necessary to carry out the analysis for every individual vehicle, only for each significant type of transport situation. While it is understood that the questions may imply a gross oversimplification of the actual situation, please try to impart as much information as possible. Please do not be limited by the questions given if there is other relevant information that you can give. "Vehicle" refers to any form of transportation, by air, land or sea. It does not include transportation during the "storage" phase of the life-cycle, eg movement from one storehouse to another on the same site.

If there are several modes of transport that you have information on, please copy and complete this section for each mode, indicating relative quantities transported by each mode.

Classification of this page: .... (when data entered)

4.5. Type of transport vehicles: _____

4.6. No of bombs usually carried in each vehicle: _____ ± _____

4.7. How are the bombs transported in the vehicle (eg 6 bombs to a pallet, 6 pallets per vehicle, pallets stacked 3 long x 2 high, stacks 1 metre apart):_____

_____

4.8. Are other materials (explosive or non-explosive) transported at the same time in the same vehicle (please list):_____

4.9. No of personnel normally in vehicle with bombs (crew, etc): _____

4.10. Cost of replacement of vehicle: $_____ ± _____

4.11. Scenario 1: Where the vehicle carrying the bombs spends most time:

4.11.1. Description of scenario:_____

_____

4.11.2. Time spent in this scenario per calendar year: _____ ± ____days/hours

4.11.3. Distance covered in this scenario per calendar year: _____ ± ____km

4.11.4. Proximity of Service buildings or other Service vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____

4.11.5. Proximity of Civilian buildings or vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____
_____	(___)	_____	$_____	± _____

4.11.6. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

4.11.7. What do you think the effect on the vehicle, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in vehicle detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

4.11.8. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in vehicle detonate   _____ ± _____Service fatalities

    _____ ± _____Civilian fatalities

(b) all Mk82 burn only   _____ ± _____Service fatalities

    _____ ± _____Civilian fatalities

4.11.9. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in vehicle detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

4.11.10. What do you think is the probability of an accidental initiation during the period of peacetime (specified in 1.5) in this scenario for this type of transport in Australia (eg 10^{-4} would indicate a one in ten thousand chance of an accidental ignition): _____ ± _____

4.11.11. What do you think would be the probability of an "unintentional" initiation in this scenario for this type of transport during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):_____ ± _____

4.12. Scenario 2: Where the probability of an accident is highest:

4.12.1. Description of scenario:_____

_____

4.12.2. Time spent in this scenario per calendar year: _____ ± ____days/hours

4.12.3. Distance covered in this scenario per calendar year: _____ ± ____km

4.12.4. Proximity of Service buildings or other Service vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____

4.12.5. Proximity of Civilian buildings or vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____
_____	(____)	_____	$ _____ ± _____

4.12.6. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

4.12.7. What do you think the effect on the vehicle, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in vehicle detonate_____
_____
_____
_____

(b) all Mk82 burn only_____
_____
_____
_____

4.12.8. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in vehicle detonate   _____ ± _____ Service fatalities
                                        _____ ± _____ Civilian fatalities

(b) all Mk82 burn only   _____ ± _____ Service fatalities
                                        _____ ± _____ Civilian fatalities

4.12.9. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

    (a) all Mk82 in vehicle detonate $ _____ ± _____

    (b) all Mk82 burn only $ _____ ± _____

4.12.10. What do you think is the probability of an accidental initiation during peacetime (specified in 1.5) that can be expected in this scenario for this type of transport in Australia (eg 10^{-3} would indicate a one in a thousand chance of an accidental ignition):
_____ ± _____

4.12.11. What do you think would be the probability of an "unintentional" initiation in this scenario by this type of transport during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):   _____ ± _____

4.13. Scenario 3: Where the consequences of an accident are likely to be most severe:

4.13.1. Description of scenario:_____
_____

4.13.2. Time spent in this scenario per calendar year: _____ ± _____ days/hours

4.13.3. Distance covered in this scenario per calendar year: _____ ± _____ km

4.13.4. Proximity of Service buildings or other Service vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____

4.13.5. Proximity of Civilian buildings or vehicles (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____
_____	(____)	_____	$ _____	± _____

4.13.6. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____
_____

4.13.7. What do you think the effect on the vehicle, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in vehicle detonate_____
_____
_____
_____

(b) all Mk82 burn only_____
_____
_____
_____

4.13.8. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in vehicle detonate _____ ± _____ Service fatalities
_____ ± _____ Civilian fatalities

(b) all Mk82 burn only _____ ± _____ Service fatalities
_____ ± _____ Civilian fatalities

4.13.9. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in vehicle detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

4.13.10. What do you think is the probability of an accidental initiation during peacetime (specified in 1.5) that can be expected in this scenario for this type of transport in Australia (eg 10^{-5} would indicate a one in a hundred thousand chance of an accidental ignition):
_____ ± _____

4.13.11. What do you think would be the probability of an "unintentional" initiation in this scenario for this type of transport during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition): _____ ± _____

4.14. Are there any other modes (air/land/sea) of Mk 82 bomb transport facility which you have information: Yes / No
If so, please repeat this section for each type, indicating relative quantities transported by each mode.

4.15. What do you think is the probability of an accidental initiation during peacetime (specified in 1.5) that can be expected for all types of transport in Australia (eg 10^{-3} would indicate a one in a thousand chance of an accidental ignition): _____ ± _____

4.16. What do you think would be the probability of an "unintentional" initiation for all types of transport during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):

_____ ± _____

4.17. How many serious explosive accidents do you know of that have occurred in Australia involving the Mk82 bomb or similar stores (eg other GP bombs) in transport (any form of transport, please attach details if available):

_____

4.18. Over what period did these occur: _____ years

4.19. Over what period do you know that there have been **no** accidents at storage facilities involving these or similar stores (eg over past 11 years): _____ years

4.20. What other units do you know of that transport Mk82 bombs and who do you think is responsible for transport aspects of the Mk82 bomb at those units:

Location:_____ Location:_____ Location:_____
Name:_____ Name:_____ Name:_____
Rank:_____ Rank:_____ Rank:_____
Unit:_____ Unit:_____ Unit:_____

5. *Operational use of Mk82 bombs - peacetime*

		0	1	2	3	4
Your level of expertise:						

This section incorporates all uses of Mk82 HE bombs at combat units, including training, practice etc during the period of peace specified in 1.5. It also covers all aspects of those uses, including loading, unloading, arming, fuzing, guidance, transport to and from weapon platforms, practice HE bombing runs, EOD of unexploded bombs, etc.

5.1. Description of peacetime operational use:

_____

_____

_____

5.2. Total no of Mk82 bombs in peacetime operational use: _____ ± _____

5.3. How do you expect this to vary over the expected life of type specified in 1.3 (extend scales if necessary):
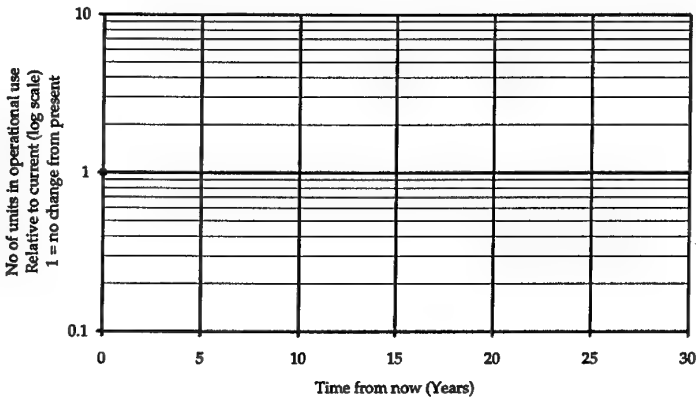
5.4. On what basis do you expect this variation:_____

_____

_____

Classification of this page: .... (when data entered)

The following questions are designed to estimate the frequency and costs of accidents of Mk82 bombs in peacetime operational use (specified in 1.5). There are three sets of questions relating to three different operational use scenarios (where the bombs spend most time, where an accident is most likely or where the consequences of an accident would be most severe). Please fill out the three scenarios so that they include all the possible environments that the bombs may experience in peacetime operational use – this may require some averaging of times, probabilities, etc. It is not necessary to carry out the analysis for every individual weapon platform etc., only for each significant type of peacetime operational situation. While it is understood that the questions may imply a gross oversimplification of the actual situation, please try to impart as much information as possible. Please do not be limited by the questions given if there is other relevant information that you can give.

If there are several types of weapon platform or types of operational use (eg guided/unguided), please copy and complete this section for each one.

5.5. Weapon platform (F/A18, F111): _____

5.6. No of Australian operational weapon platforms of this type: _____ ± _____

5.7. No of bombs carried on each platform in peacetime operational use: _____ ± _____

5.8. Cost of replacement of platform: $_____ ± _____

5.9. Scenario 1: Where the bombs spend most time:

5.9.1. Description of scenario:_____
_____

5.9.2. Time spent in this scenario per peacetime calendar year: _____ ± _____days/years

5.9.3. Proximity of Service/civilian buildings/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number	Distance (m)	Replacement cost (each)
_____ ( )	_____	$_____ ± _____
_____ ( )	_____	$_____ ± _____
_____ ( )	_____	$_____ ± _____
_____ ( )	_____	$_____ ± _____

5.9.4. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

5.9.5. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____
_____
_____
_____

Classification of this page: .... (when data entered)

(b) all Mk82 burn only_____
_____
_____
_____

5.9.6. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

    (a) all Mk82 in stack or on rack detonate   _____ ± _____Service fatalities
                                        _____ ± _____Civilian fatalities

    (b) all Mk82 burn only   _____ ± _____Service fatalities
                                          _____ ± _____Civilian fatalities

5.9.7. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

    (a) all Mk82 in stack or on rack detonate $_____ ± _____

    (b) all Mk82 burn only $_____ ± _____

5.9.8. What do you think is the probability of an Australian accidental initiation during peacetime (specified in 1.5) that can be expected in this scenario (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):   _____ ± _____

5.10. Scenario 2: Where the probability of an accident is highest:

5.10.1. Description of scenario:_____
_____

5.10.2. Time spent in this scenario per calendar year: _____ ± _____days/hours

5.10.3. Proximity of Service/Civilian buildings/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	( )	_____	$_____	±
_____	( )	_____	$_____	±
_____	( )	_____	$_____	±
_____	( )	_____	$_____	±

5.10.4. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

5.10.5. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

5.10.6. How many, if any, fatalities or serious casualties would you expect if:

(a) all Mk82 in stack or on rack detonate _____ ± _____Service fatalities

_____ ± _____Civilian fatalities

(b) all Mk82 burn only _____ ± _____Service fatalities

_____ ± _____Civilian fatalities

5.10.7. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in stack or on rack detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

5.10.8. What do you think is the probability of an Australian accidental initiation during peacetime (specified in 1.5) that can be expected in peace time in this scenario (eg 10^{-1} would indicate a one in ten chance of an accidental ignition):   _____ ± _____

5.11. Scenario 3: Where the consequences of an accident are likely to be most severe:

5.11.1. Description of scenario:_____

_____

5.11.2. Time spent in this scenario per calendar year: _____ ± _____days/hours

5.11.3. Proximity of Service/Civilian building/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number	Distance (m)	Replacement cost (each)
_____ (___)	_____	$_____ ± ___
_____ (___)	_____	$_____ ± ___
_____ (___)	_____	$_____ ± ___
_____ (___)	_____	$_____ ± ___

5.11.4. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

5.11.5. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

5.11.6. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in stack or on rack detonate   _____ $\pm$ _____Service fatalities
    _____ $\pm$ _____Civilian fatalities

(b) all Mk82 burn only   _____ $\pm$ _____Service fatalities
    _____ $\pm$ _____Civilian fatalities

5.11.7. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in stack or on rack detonate $_____ $\pm$ _____

(b) all Mk82 burn only $_____ $\pm$ _____

5.11.8. What do you think is the probability of an Australian accidental initiation during the period of peacetime (specified in 1.5) that can be expected in this scenario (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):   _____ $\pm$ _____

5.12. Are there any other weapon platforms or types of peacetime operational use involving Mk 82 bombs for which you have information: <u>Yes / No</u>
If so, please repeat this section for each type, indicating relative quantities involved in each.

5.13. What do you think is the total probability of an accidental initiation during the period of peacetime (specified in 1.5) that can be expected in Australian operational use (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition): _____ $\pm$ _____

5.14. How many serious Australian explosive accidents do you know of that have occurred involving the Mk82 bomb or similar stores (eg other GP bombs) in operational use in peacetime (please attach details if available):_____

5.15. Over what period did these occur: _____years

5.16. Over what period do you know that there have been **no** accidents in operational use involving these or similar stores in peacetime (eg over past 11 years):_____years

5.17. What other units do you know of that use Mk82 bombs in an operational environment and who do you think is responsible for operational use aspects of the Mk82 bomb at those units:

Location:_____   Location:_____   Location:_____
Name:_____   Name:_____   Name:_____
Rank:_____   Rank:_____   Rank:_____
Unit:_____   Unit:_____   Unit:_____

6. Operational use of Mk82 bombs - wartime

Your level of expertise:

| 0 | 1 | 2 | 3 | 4 |

This section incorporates all uses of Mk82 HE bombs at combat units during the period of "wartime" defined in 1.4 above. This includes short-term storage for operational use, sorties, etc. It also covers all aspects of those uses, including loading, unloading, arming, fuzing, guidance, transport to and from weapon platforms, EOD of unexploded enemy bombs (but only to the extent that they involve Australian Mk82 bombs), etc. It also includes normal operations during the period of war which are otherwise similar to those given in the previous section for the peacetime phase.

6.1. Description of operational use: _____

_____

6.2. Total no of Mk82 bombs in operational use: _____ ± _____

6.3. How do you expect this to vary over the period of war specified in 1.4 (extend scales if necessary):

No of units in operational use
Relative to peacetime stocks at
start of hostilities (log scale) 1 =
no change

Time in conflict (Years)
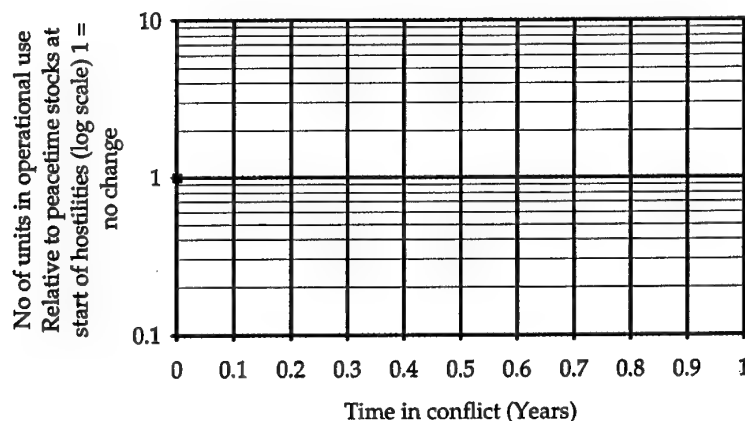
6.4. On what basis do you expect this variation:_____

_____

_____

Classification of this page: .... (when data entered)

> The following questions are designed to estimate the frequency and costs of accidents of Mk82 bombs in wartime operational use. There are three sets of questions relating to three different operational use scenarios (where the bombs spend most time, where an accident is most likely or where the consequences of an accident would be most severe). Please fill out the three scenarios so that they include all the possible environments that the bombs may experience in wartime operational use – this may require some averaging of times, probabilities, etc. It is not necessary to carry out the analysis for every individual weapon platform etc., only for each significant type of wartime operational situation. While it is understood that the questions may imply a gross oversimplification of the actual situation, please try to impart as much information as possible. Please do not be limited by the questions given if there is other relevant information that you can give.
>
> If answers are the same as those given for the peacetime situation, please write "as above".
>
> If there are several types of weapon platform or types of operational use (eg guided/unguided), please copy and complete this section for each one.

6.5. Weapon platform (eg F/A18, F111): _____

6.6. No of operational weapon platforms of this type: _____ ± _____

6.7. No of bombs carried on each platform during wartime operational use: _____ ± _____

6.8. Cost of replacement of platform: $_____ ± _____

6.9. Scenario 4: Where the bombs spend most time:

  6.9.1. Description of scenario: _____
  _____

  6.9.2. Time spent in this scenario during the period of war: _____ ± _____ days/years

  6.9.3. Proximity of Service/civilian buildings/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(____)	_____	$_____	± _____
_____	(____)	_____	$_____	± _____
_____	(____)	_____	$_____	± _____
_____	(____)	_____	$_____	± _____

  6.9.4. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details: _____

6.9.5. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

6.9.6. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in stack or on rack detonate	_____ ± ____	Service fatalities
	_____ ± ____	Civilian fatalities
(b) all Mk82 burn only	_____ ± ____	Service fatalities
	_____ ± ____	Civilian fatalities

6.9.7. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in stack or rack detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

6.9.8. What do you think would be the probability of an Australian "unintentional" initiation in this scenario for this type of transport during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):   _____ ± _____

6.10. Scenario 5: Where the probability of an accident is highest:

6.10.1. Description of scenario:_____

_____

6.10.2. Time spent in this scenario during the period of war:_____ ± _____days/hours

6.10.3. Proximity of Service/Civilian buildings/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number	Distance (m)	Replacement cost (each)
_____ ( )	_____	$_____ ± ____
_____ ( )	_____	$_____ ± ____
_____ ( )	_____	$_____ ± ____

_____ (   ) _____ $ _____ ± _____

6.10.4. Proximity of Civilian buildings or vehicles (please draw sketch on back if necessary):

Type and number	Distance (m)	Replacement cost (each)	
_____ ( )	_____	$_____	±
_____ ( )	_____	$_____	±
_____ ( )	_____	$_____	±
_____ ( )	_____	$_____	±

6.10.5. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

6.10.6. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

6.10.7. How many, if any, fatalities or serious casualties would you expect if:

(a) all Mk82 in stack or on rack detonate   _____ ± _____Service fatalities
                                                 _____ ± _____Civilian fatalities

(b) all Mk82 burn only   _____ ± _____Service fatalities
                                                 _____ ± _____Civilian fatalities

6.10.8. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in stack or on rack detonate $_____ ± _____

(b) all Mk82 burn only $_____ ± _____

6.10.9. What do you think would be the probability of an Australian "unintentional" initiation in this scenario during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 1 would indicate that it is likely that there will be one accidental ignition during the period specified in 1.4):   _____ ± _____

6.10.10. Scenario 6: Where the consequences of an accident are likely to be most severe:

6.10.11. Description of scenario:_____

_____

6.10.12. Time spent in this scenario during the period of war:_____±_____days/hours

6.10.13. Proximity of Service/Civilian building/vehicles or weapon platforms (please draw sketch on back if necessary):

Type and number		Distance (m)	Replacement cost (each)	
_____	(___)	_____	$	±
_____	(___)	_____	$	±
_____	(___)	_____	$	±
_____	(___)	_____	$	±

6.10.14. Are there any significant natural hazards (eg flood, lightning, tall grass which may catch fire) which may contribute either to the probability or to the consequences of an accident. If so, please give details:_____

6.10.15. What do you think the effect on other munitions, weapons platforms, surrounding vehicles, surrounding buildings, etc would be (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) given that:

(a) all Mk82 in stack or on rack detonate_____

_____

_____

_____

(b) all Mk82 burn only_____

_____

_____

_____

6.10.16. How many, if any, fatalities or serious casualties would you expect (please include response of other munitions in contributing to the damage and credible emergency response procedures, firefighting, etc) if:

(a) all Mk82 in stack or on rack detonate   _____±_____Service fatalities
      _____±_____Civilian fatalities

(b) all Mk82 burn only   _____±_____Service fatalities
      _____±_____Civilian fatalities

6.10.17. What do you think the clean-up cost would be after such an accident, not including cost of replacement of buildings, compensation, etc:

(a) all Mk82 in stack or on rack detonate $_____±_____

(b) all Mk82 burn only $_____±_____

6.10.18. What do you think would be the probability of an Australian "unintentional" initiation in this scenario during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):

_____ ± _____

6.11. Are there any other weapon platforms or types of wartime operational use involving Mk 82 bombs for which you have information: Yes / No
If so, please repeat this section for each type, indicating relative quantities involved in each.

6.12. What do you think would be the total probability of an "unintentional" initiation in Australian operational use during the period of war that you specified in 1.4 above, including initiations due to enemy action (eg 10^{-2} would indicate a one in a hundred chance of an accidental ignition):

_____ ± _____

6.13. How many serious Australian explosive accidents do you know of that have occurred involving the Mk82 bomb or similar stores (eg other GP bombs) in operational use (please attach details if available):_____

6.14. Over what period did these occur: _____years

6.15. Over what period do you know that there have been **no** accidents in operational use involving these or similar stores (eg over past 11 years):_____years

6.16. It is possible that some IM fills for the Mk82 bomb may have higher or lower explosive performance than the current H6 fill. This question involves effects of a hypothetical change in performance of the Mk82 bomb. These will be used as scaling factors to apply the answers given above to IM fills.

6.16.1. What would be the effect on fuzing options if the performance of the Mk82 bomb were (as a percentage of current performance):
(a) 90%_____

_____

(b) 110%_____

_____

6.16.2. What would be the effect on guidance options if the performance of the Mk82 bomb were (as a percentage of current performance):
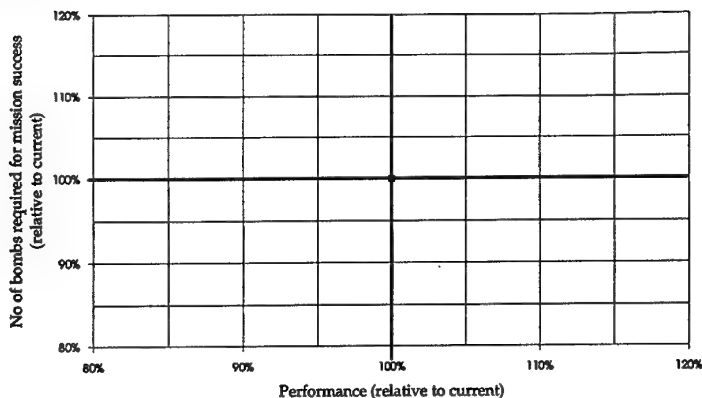(a) 90%_____

_____

(b) 110%_____

_____

6.16.3. What would be the effect on the number of bombs required to achieve a mission goal (eg target kill, etc) if the performance of the Mk82 bomb were (as a percentage of current performance):

Classification of this page: .... (when data entered)

6.16.4. What would be the effect on the number of sorties required to achieve a mission goal (eg target kill, etc) if the performance of the Mk82 bomb were (as a percentage of current performance):
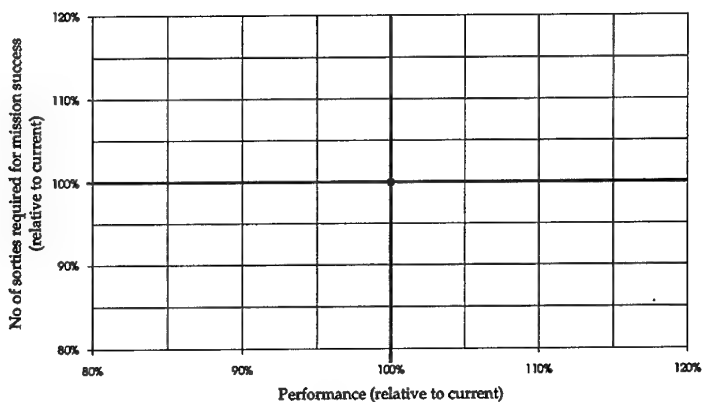
6.16.5. What would be the effect on the total inventory given in 1.2 if the performance of the Mk 82 bomb were (as a percentage of current performance):

(a) 90%_____

_____

(b) 110%_____

_____

Other people who may have an input on aspects of this work:

Please indicate area of expertise (eg qualification, storage, transport, operational use)

Name:_____   Name:_____
Rank:_____   Rank:_____
Unit:_____   Unit:_____
Location:_____   Location:_____
Area of expertise:_____   Area of expertise:_____

Name:_____   Name:_____
Rank:_____   Rank:_____
Unit:_____   Unit:_____
Location:_____   Location:_____
Area of expertise:_____   Area of expertise:_____

Other factors which should be considered in the analysis (please quantify if possible):

_____
_____
_____
_____

Other relevant references or sources of information:

_____
_____
_____
_____

Ways in which this form could be improved:

_____
_____
_____
_____

Please send me the following sections:

☐ General aspects   ☐ Qualification and introduction into service of an IM variant
☐ Storage   ☐ Transport
☐ Operational use - peacetime   ☐ Operational use - wartime

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TITLE

A questionnaire for the cost-benefit analysis of an insensitive variant of the Mk82 HE general purpose bomb

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ABSTRACT

An Insensitive Munitions (IM) policy, described in DI(G) LOG 07-10, is being implemented by the Australian Defence Organisation. DSTO was tasked to develop a methodology to assess the cost-benefits afforded by the introduction of IM, which is a critical component in the implementation of this policy. As part of this task, it is being applied to two munitions to refine and validate the methodology. This report describes a questionnaire devised to obtain input data for the estimation of the cost-benefit afforded by the introduction of an insensitive variant of the Mk82 HE General Purpose Bomb. It may be used as an example of a questionnaire to obtain similar types of data for other studies.

A Questionnaire for the Cost-Benefit Analysis of an Insensitive
Variant of the Mk82 HE General Purpose Bomb

A. White

(DSTO-GD-0020)

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